

Constellation-X SXT Mirror

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The SXT team

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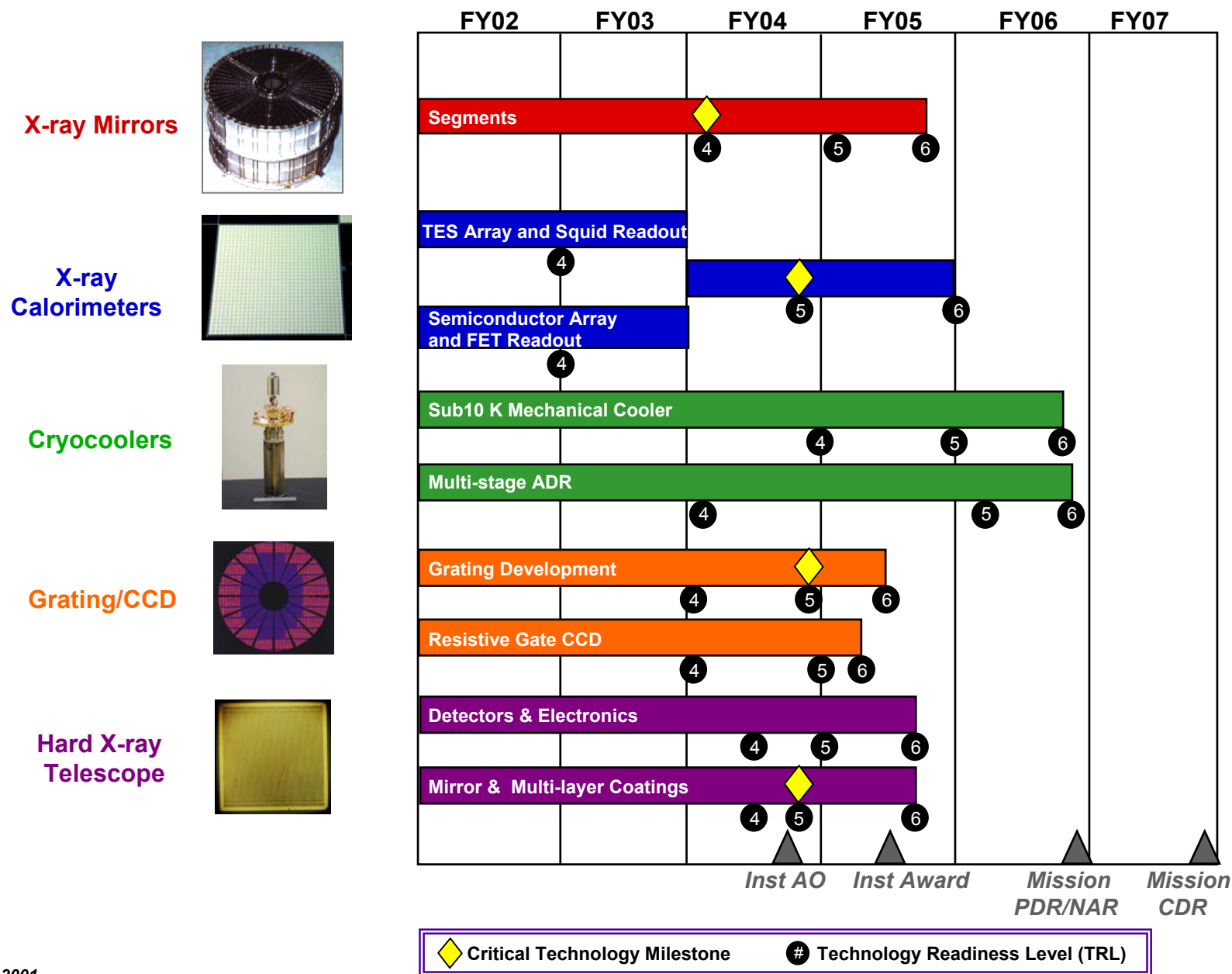
R. Harms (RJH Scientific)

Segmented SXT Mirror

Outline

- **SXT Program Overview** R. Petre
- **Engineering Unit** R. Petre (for J. Stewart)
- **Metrology** R. Petre (for D. Content)
- **Glass Forming Process** W. Zhang
- **Alignment Bars** X. Sun
- **MSFC Support** S. Odell

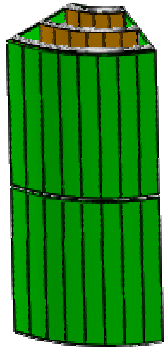
Constellation-X Summary Technology Roadmap



SXT Phased Development

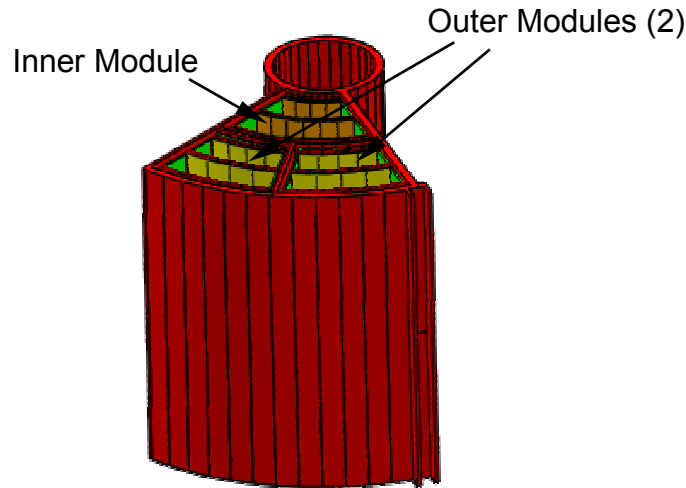


Engineering Unit



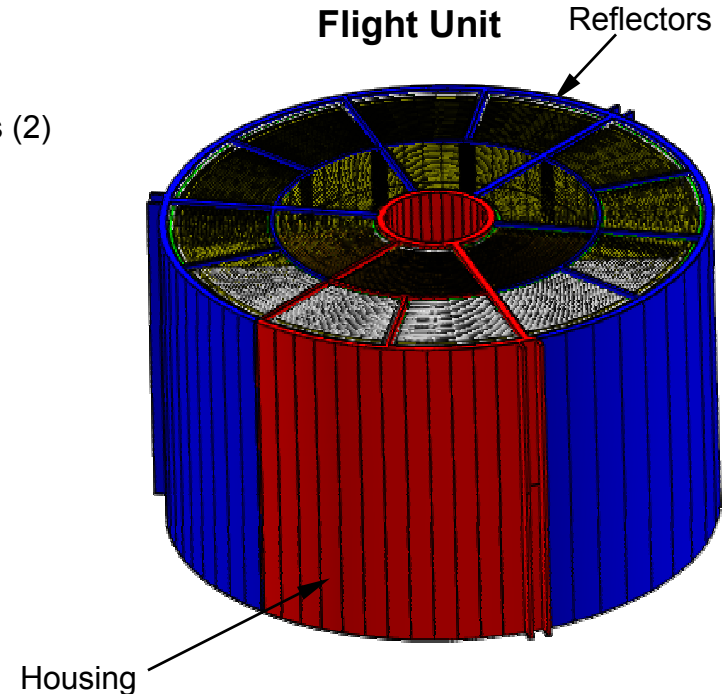
- Single inner module with
- 0.5 m dia. reflector pair (replicated from Zeiss precision mandrel)
 - Parabolic (P) and Hyperbolic (H) submodules
 - First modules to be aligned using etched silicon microcombs

Prototype Unit



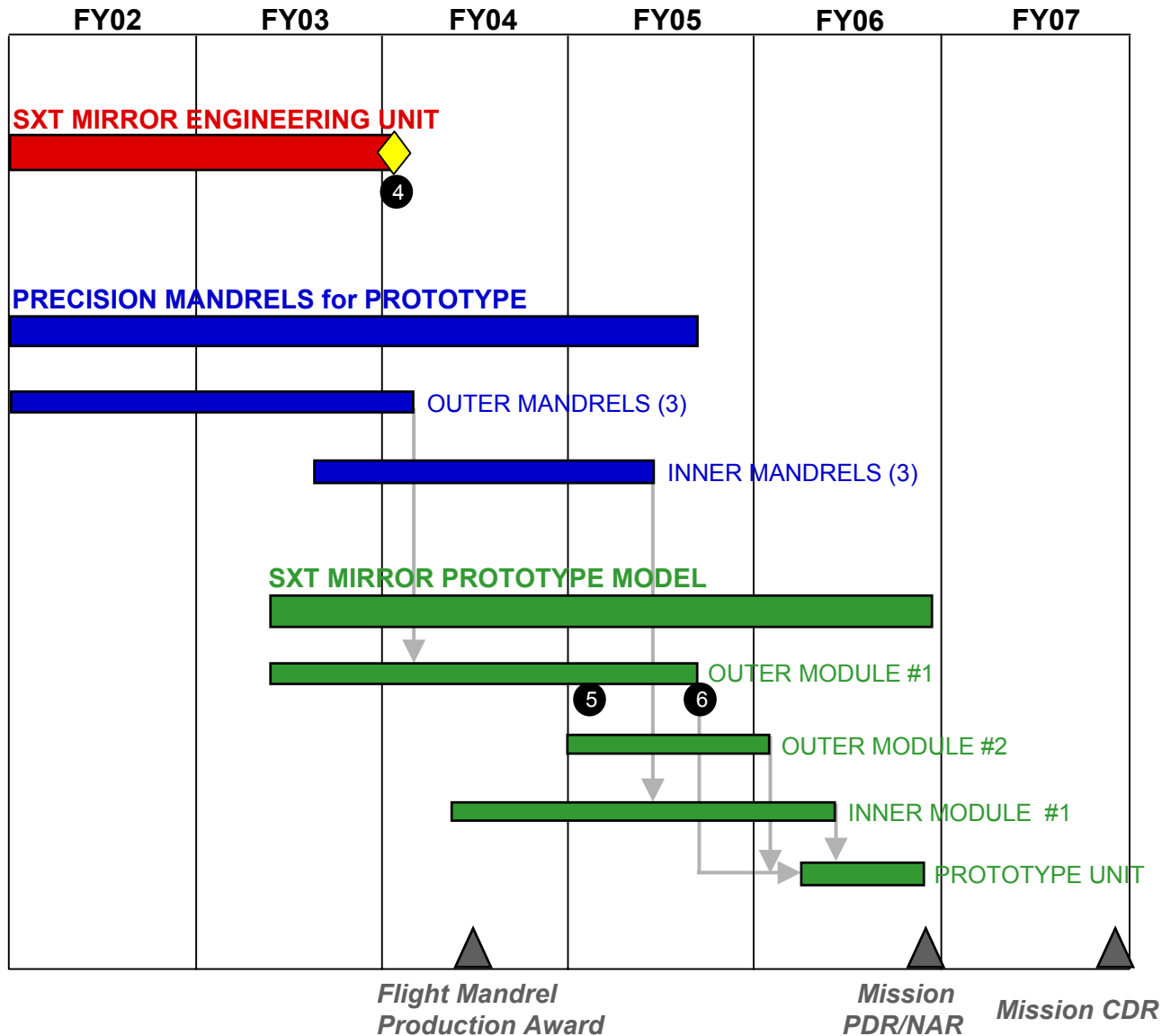
- Flight Scale Assembly of
- 3 modules (2 outer and 1 inner)
 - Largest diameter same as for flight - 1.6 m
 - Each module has 3 to 9 reflector pairs
 - Demonstrates module to module alignment

Flight Unit



- Full flight Assembly
- 1.6 m outer diameter
 - 18 Small Modules
 - 70 to 170 reflector diameters

SXT Optic Technology Roadmap



Critical Technology Milestone



Technology Readiness Level (TRL)

SXT Optic Critical Technology Milestone

◆ SXT Optic Engineering Unit Completed and Tested in X-rays

- Alignment comb fabrication process verified.
- Assembly and alignment procedures established.
- Optical performance understood and extendable to 10 arc sec.
- Replication process satisfies requirements and is reproducible.
- Reflector support concept verified.
- Preliminary mechanical testing satisfactorily completed.

SXT Engineering Unit

- **Goal is to approach Con-X resolution requirement in unit incorporating all aspects of SXT flight system**
 - Precisely formed segments
 - Etched Si alignment bars
 - Flight assembly and metrology approach
- **EU is flight-like size (inner module)**
- **Utilizes existing Zeiss metal mandrels**
 - (50 cm dia.; 8.4 m f.l.; 5" surface)
- **Phased build up, with increasing complexity**
- **Units will be tested in X-rays and subjected to environmental testing**

SXT Development Units

- **AEU #1**

- Aluminum Engineering Unit (AEU) - aluminum housing
- One pair of reflectors (one P and one matching H).

- **AEU #2**

- Aluminum housing
- Three pairs of reflectors (three P and three matching H)

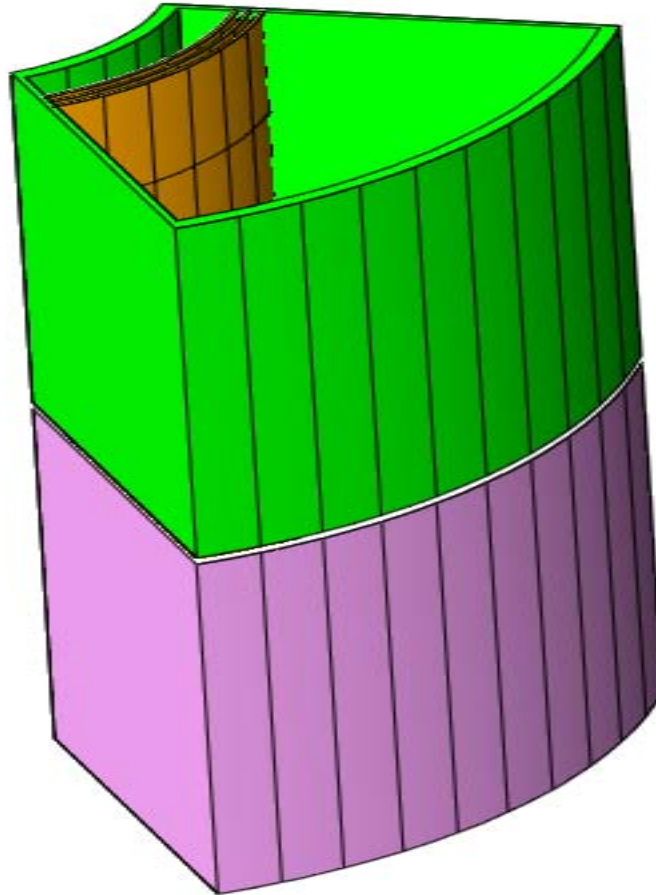
- **CEU#1**

- Composite housing
- Three Pairs of reflectors (three P and three matching H)

- **Prototype**

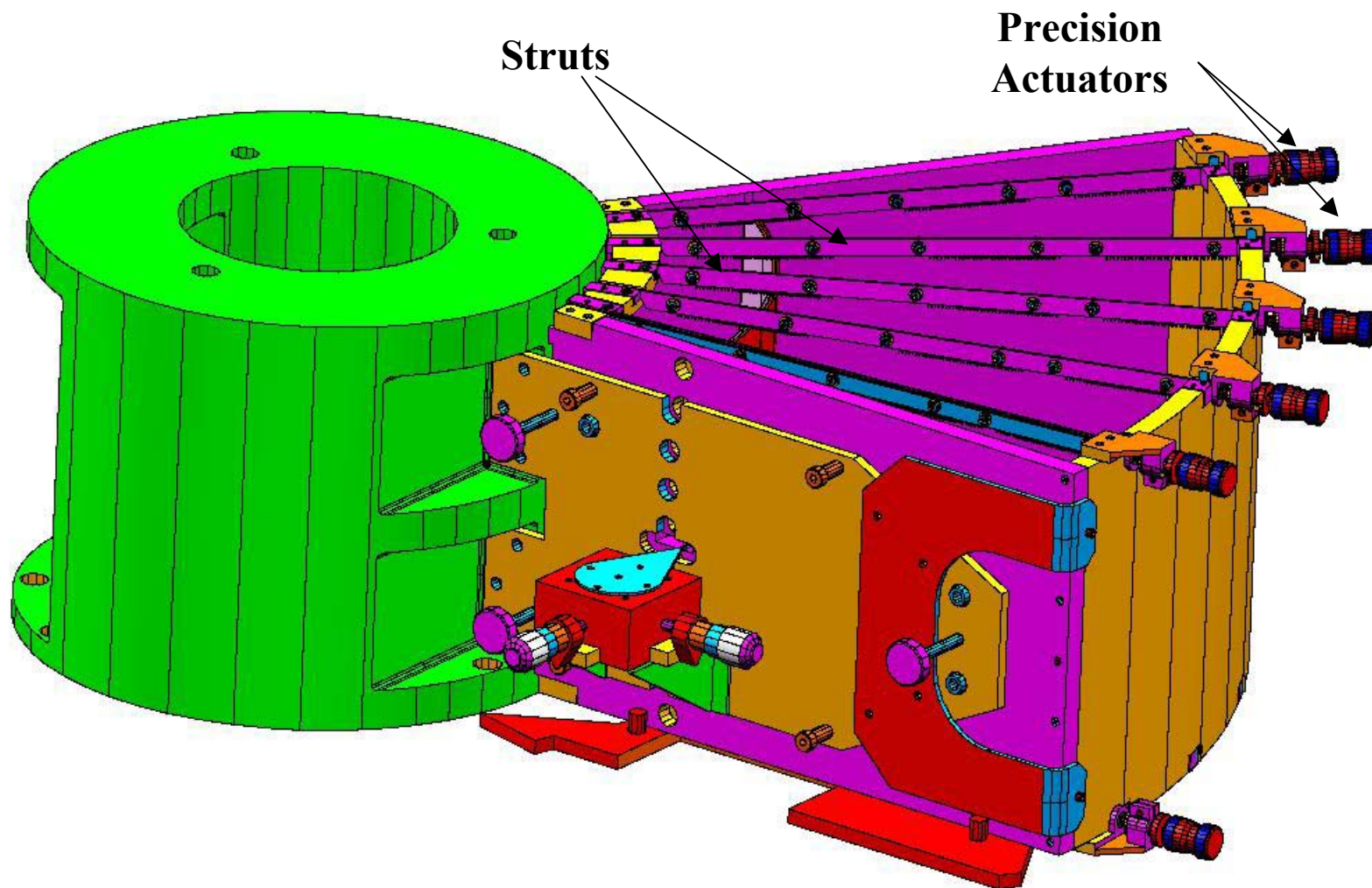
- One inner module and two outer modules with composite housings
- Each module has 3 sets of 3 reflector pairs (27 pairs; 18 different radii)

SXT Engineering Unit



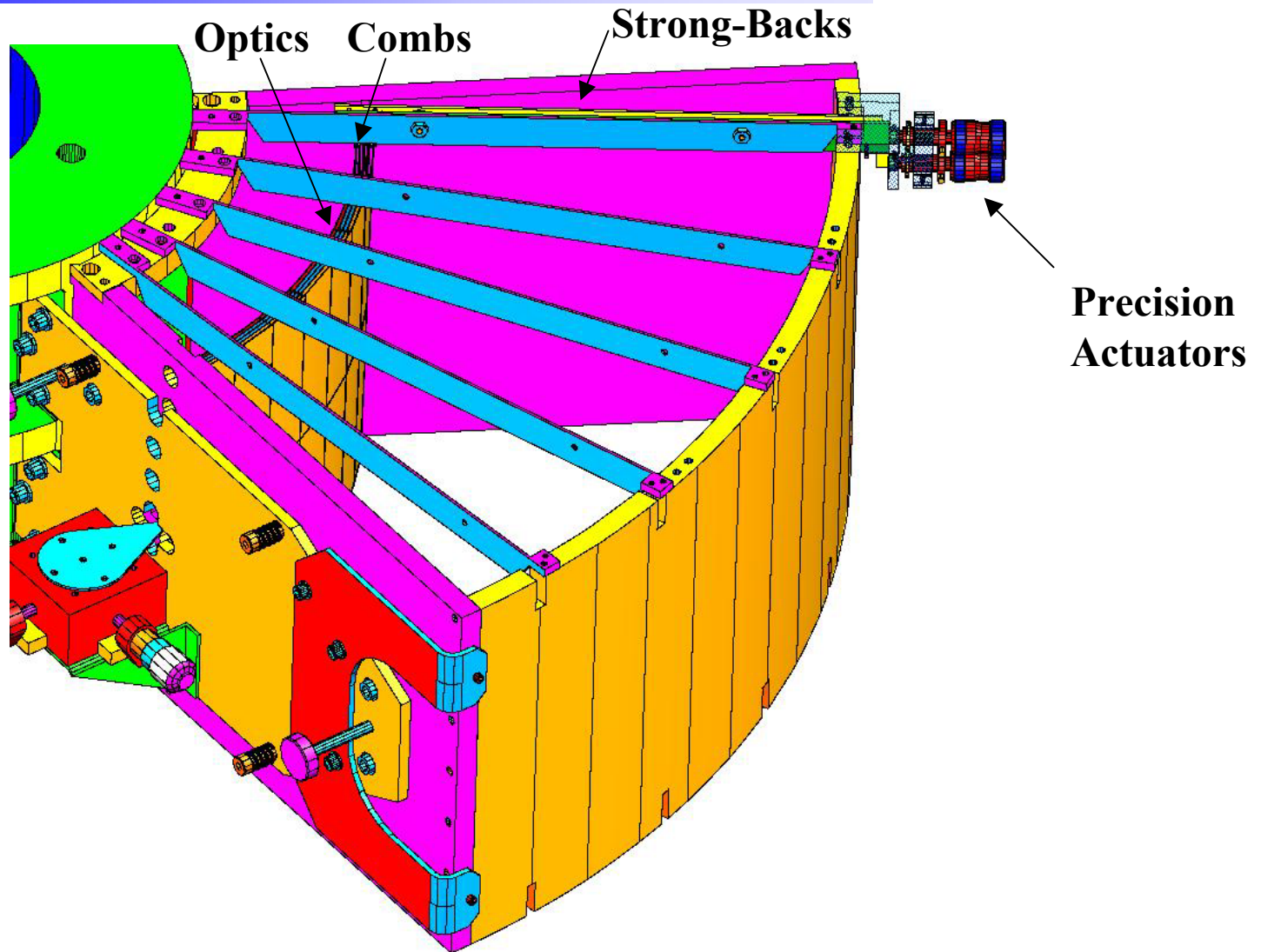
EU Assembly

Strut Installation



EU Assembly

Optic Installation



C-X SXT Engineering Unit -

Update on metrology

-- D. Content



Technical summary:

- Proposed metrology on individual reflectors, in priority order
 - form (e.g. cone angle/ radius measurements) - Moore#3 {ready}
 - axial figure -- Wyko400 or Zygo MkIV interferometers {available, need to set up 20cm collimator for EU scale tests}
 - micro and nano roughness - Microroughness on foils or 20cm mandrels now available in B2, 2 devices in B5; Topo3d upgrade for 50cm mandrels is in design phase now; nano roughness metrology is a low priority
 - circumferential figure -- Moore #3 may be required, as errors too large for interferometer on sample part measured recently {ready}
 - midfrequency -- not a driver at this time - use current Bauer and/or subaperture interferometry (lateral resolution down to < 1 mm)
- Form and figure metrology on the EM
 - same as above - work to allow axial figure metrology in situ either w/ interferometers or Moore#3
- Main lack right now is a holding fixture for 1000:1 aspect ratio foils
 - Without fixturing, there is a strong tendency to measure your mounting condition and not the unstressed condition of the foil
 - This is being addressed now

Segmented SXT Mirror

Issues

— Technical

- Limits of substrate (available size, usable size, thickness required, ultimate figure attainable)
- Increasing complexity of fixturing
- Completeness and accuracy of metrology approach

— Programmatic

- Ambitious program development timescale hampered by lack of funds
- Cost and production rate of mandrels
- Availability of industrial partner to carry out mirror production